

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Hydraulic Accumulator and GN2 Charging Assembly

PART NO.:

FM CODE: A03

(1) Hydraulic Accumulator
P/N: 10207-0002-803

(3) Lines and Fittings
includes: GN2 Rigid Lines
P/N: 10200-0072-101 (Rock)

GN2 Fitting Plug, Bleeder
P/N: MS24391S4L
Alt: MS24391J4L

P/N: 10200-0072-103 (Alt)
P/N: 10200-0072-102 (Tilt)
P/N: 10200-0072-104 (Alt)

Vent Fitting, Plug, Bleeder
P/N: MS24391J5L
MS24391K5L (Alt)

GN2 Fitting, Elbow
P/N: 10209-0067-801
P/N: 10209-0132-801 (Alt)

(2) GN2 Pressure Block Assembly
P/N: 10207-0020-104 (Rock)
P/N: 10207-0021-104 (Tilt)
includes:

GN2 Fitting, Connector
P/N: 10209-0034-801

Valve, Fill
P/N: 10201-0057-801

Hydraulic Fitting, Connector
P/N: 10209-0035-801

Pressure Transducer
P/N: 10400-0126-801

O-rings
Type: M83248/1

Fitting, Connector
P/N: 10209-0034-801

Fitting, Plug, Bleeder
P/N: MS24391J4L

ITEM CODE: 20-01-49

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Seconds

NO. REQUIRED: 2

DATE: March 1, 2001

CRITICAL PHASES: Final Countdown, Boost

SUPERCEDES: March 31, 2000

FMEA PAGE NO.: A-161

ANALYST: B. Snook/S. Parvathaneni

SHEET 1 OF 6

APPROVED: S. Parvathaneni

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FAILURE MODE AND CAUSES: External leakage of hydraulic fluid (System A and/or B) at accumulator hydraulic piston end seal and vent fitting O-ring caused by:

- o Contamination
- o Defective or damaged seal
- o Defective or damaged sealing surface
- and-
- o Contamination
- o Defective or damaged o-ring
- o Defective or damaged sealing surface
- o Improperly lockwired
- o Improper torque
- o Thread failure

FAILURE EFFECT SUMMARY: Fire and explosion will lead to loss of mission, vehicle and crew.

REDUNDANCY SCREENS AND MEASUREMENTS:

- o Pass - Units are subject to ATP testing during turnaround.
- o Fail - Loss of internal seal not readily detectable.
- o Fail - Contamination.

RATIONALE FOR RETENTION:

A. DESIGN

- o The Hydraulic Accumulator and GN2 Charging Assembly is designed and qualified in accordance with end item specification 10SPC-0051. (All Failure Causes)
- o The accumulator is designed for a proof pressure of two times operating pressure (6500 psig) and a burst pressure of four times operating pressure (13,000 psig). (Thread Failure, Defective or Damaged Sealing Surface)
- o Fittings are lockwired per MS33540 with Monel Lockwire. (Improperly Lockwired)
- o O-rings are in accordance with MS 28775 or MS 28778 and are compatible with hydraulic fluid. (Defective or Damaged O-ring, Contamination)
- o Hydraulic fluid is MIL-H-83282 or MIL-PRF-83282 which was developed to minimize the fire hazard. (Contamination)
- o Fluid procurement is controlled by SE-S-0073. (Contamination)
- o The accumulator is located downstream of the filter assembly, which is a 5 micron filter. (Contamination)

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- o Aft skirt area is purged with GN2 prior to APU start. This reduces the O2 concentration to less than four percent per OMRSD File II, Vol. 1, requirement number S00FM0.430. (All Failure Causes)
- o Designed burst was verified during qualification testing per 10SPC-0051. (Thread Failure)
- o Qualification testing verified design requirements as reported in Parker-Hannifin Qualification Test Report QTR 5790001, Rev. Basic. (All Failure Causes)

B. TESTING

- o Acceptance testing is performed per Parker-Hannifin ATP PTS 5790001 at vendor's plant. This includes visual examination, proof pressure test to 6500 psig, performance and leakage tests, bonding and cleanliness. (All Failure Causes)
- o During refurbishment and prior to reuse the accumulator is processed for rework per 10SPC-0131 acceptance tested per the criteria of 10SPC-0051 by USA SRBE/TBE Florida operations. This includes visual examination, proof pressure test to 6600 ± 100 psig, leakage, bonding, and cleanliness. (All Failure Causes)
- o Hydraulic circuit fluid leak test is performed per 10REQ-0021, para. 2.3.12.2 prior to hotfire. (All Failure Causes)
- o Functional test is performed during hotfire operations per 10REQ-0021, para. 2.3.11, 2.3.15 and 2.3.16 respectively for:
 - Low speed GN2 spin
 - High speed GN2 spin
 - Hotfire
- o The accumulator vent port plug is installed for flight, torqued and lockwired per 10REQ-0021, para. 2.1.4. This is the last check prior to launch. (All Failure Causes)
- o Helium is verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board circuits per 10REQ-0021, para. 2.3.2.5. (Contamination)
- o Hydraulic fluid is verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board hydraulic circuits per 10REQ-0021, para. 2.3.2.6. (Contamination)
- o Effluent hydraulic fluid is verified for moisture content and cleanliness (water content and particulate count) from the rock actuator, the tilt reservoir, the rock reservoir and the tilt actuator per 10REQ-0021, para. 2.3.12.3. (Contamination)

- o The accumulator vent port plug is removed during all ground hydraulic operations. The port is leak checked for less than 0.25 cc/hr per 10REQ-0021, para. 2.3.8.6. This tests piston seal leakage. (Defective or Damaged Sealing Surface)
- o The accumulator vent port plug is verified for proper torque and lockwire per OMRSD File II, Vol. 1, requirement numbers B42GEN.010 and .020. (Improper Torque, Improper Lockwire)
- o Hydraulic fluid is verified for cleanliness and composition (purity and particulate count) prior to introduction to on-board hydraulic circuits during prelaunch operations per OMRSD File V, Vol. 1, Requirement Number B42HP0.010. (Contamination)
- o Prelaunch hydraulic system leak test is performed per OMRSD File V, Vol. 1, Requirement Number B42HP0.020. (All Failure Causes)
- o Visual leak check of hydraulic circuit (system) joints is performed per 10REQ-0021, para. 2.3.12.2. (All Failure Causes)

The above referenced OMRSD testing is performed every flight.

C. INSPECTION

I. VENDOR RELATED INSPECTIONS

- o Verification of material certifications by USA SRBE PQAR per SIP 1125. (Thread Failure)
- o Verification of threads by USA SRBE PQAR per SIP 1125. (Thread Failure)
- o Vendor inspection of seals is verified by USA SRBE PQAR per SIP 1125. (Defective or Damaged O-ring)
- o Verification of leakage tests USA SRBE PQAR per SIP 1125. (All Failure Causes)
- o Witnessing of accumulator assembly acceptance test is performed by USA SRBE PQAR per SIP 1125. (All Failure Causes)
- o Verification of seal interfaces and lockwire is performed by USA SRBE PQAR per SIP 1125. (Improperly Lockwired)
- o Critical Processes/Inspections:
 - Shot peening per MIL-STD-852

II. KSC RELATED REFURBISHMENT INSPECTION

- o Visual inspection of accumulator will be performed per 10SPC-0131, para. II. (All Failure Causes)
- o Functional testing of accumulator will be performed per 10SPC-0131, paragraph IV.

All manual tests will be witnessed by Quality or verified for those instances when controlled software is utilized and a test report is generated. (All Failure Causes)

III. KSC RELATED ASSEMBLY AND OPERATIONS INSPECTIONS

- o Assembly and torque are witnessed per 10REQ-0021, para. 2.1.4. (Improper Torque)
- o Lockwire is verified per 10REQ-0021, para. 2.1.4. (Improperly Lockwired)
- o Hydraulic system leak test with helium is verified per 10REQ-0021, para. 2.3.3.3. (All Failure Causes)
- o Verify Rock Hydraulic Reservoir level is greater than 30 percent during low speed GN2 spin per 10REQ-0021, para. 2.3.11.2. (All Failure Causes)
- o Verify Tilt Hydraulic Reservoir level is greater than 30 percent during low speed GN2 spin per 10REQ-0021, para. 2.3.11.2. (All Failure Causes)
- o Verify Rock Hydraulic Reservoir level is greater than 50 percent during high speed GN2 spin per 10REQ-0021, para. 2.3.15.2. (All Failure Causes)
- o Verify Tilt Hydraulic Reservoir level is greater than 50 percent during high speed GN2 spin per 10REQ-0021, para. 2.3.15.2. (All Failure Causes)
- o Proper function of TVC system is verified during hotfire per 10REQ-0021, para. 2.3.16 (includes verification of rock and tilt reservoirs between 50 and 90 percent). (All Failure Causes)
- o Installation, torque and lockwiring of the vent port plug for flight is witnessed per 10REQ-0021, para. 2.1.4. (Improper Torque, Improperly Lockwired)
- o Helium cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board circuits per 10REQ-0021, para. 2.3.2.5. (Contamination)
- o Hydraulic fluid cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board hydraulic circuits per 10REQ-0021, para. 2.3.2.6. (Contamination)
- o Verification of visual leak check of hydraulic circuit (system) joints per 10REQ-0021, para. 2.3.12.2. (All Failure Causes)
- o Hydraulic circuit fluid leak test is witnessed/verified per 10REQ-0021, para. 2.3.12.2 prior to hotfire. (All Failure Causes)
- o Accumulator vent port plug leakage is verified per 10REQ-0021, para. 2.3.8.6 prior to hotfire. (All Failure Causes)

- o TVC System is inspected for external leaks per 10REQ-0021, para. 2.3.11.3, 2.3.15.5 and 2.3.16.4 respectively following low speed GN2 spin, high speed GN2 spin and post Hotfire inspection. (All Failure Causes)
- o Hydraulic fluid cleanliness and composition (purity and particulate count) are verified prior to introduction to on-board hydraulic circuits during prelaunch operations per OMRSD File V, Vol. 1, Requirement Number B42HP0.010. (Contamination)
- o Prelaunch hydraulic system leak test is performed per OMRSD File V, Vol. 1, Requirement Number B42HP0.020. (All Failure Causes)
- o Hydraulic sealing surfaces are inspected prior to installation verifying no contaminant or obstruction exists per 10REQ-0021, para. 2.3.0.(Defective or Damaged Sealing Surface)

D. FAILURE HISTORY

- o Failure Histories may be obtained from the PRACA database.

E. OPERATIONAL USE

- o Not applicable to this failure mode.